Carrier
HEATING & COOLING

38GP
Air-Cooled Condensing Units

Installation and Start-Up Instructions

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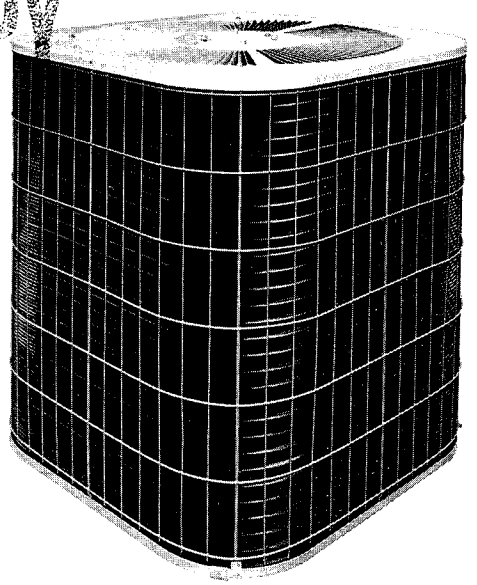


Fig. 1—Model 38GP

Important—Read Before Installing

Check the power supply: Voltage, frequency, and phase must correspond to that specified on the unit rating plate. The power supply must be able to handle the additional electrical load imposed by this equipment.

The Model 38GP Condensing Unit does not have a transformer; therefore, the fan-coil or blower package transformer (or another source) must be used as a low-voltage supply. The low-voltage supply must have an additional capacity of 15VA to handle the load imposed by this equipment.

The compressor motor is equipped with an internal protector. Excessive current or temperature will cause the protector to open, giving the indication of an open circuit in the motor winding. Sufficient time should be allowed for the overload to reset before assuming the compressor has an open winding.

The compressor motor is designed to start under low-load conditions only (high- and low-side pressures equalized) and within the specified operating voltage range. Make sure that system pressures have equalized before attempting to start the unit. Equalization takes approximately 3 minutes. The owner should be informed not to short-cycle the unit with the thermostat as this will cause the compressor to tripout on overload.

Each condensing unit is shipped with a refrigerant charge that is adequate for most systems using matching coils and refrigerant tubing kits. This charge is adequate for up to 25 feet of interconnecting tubing. For tube lengths greater or less than 25 feet, the refrigerant charge must be adjusted. See Table 2 for charge quantity and refer to refrigerant-tube sizing, Tables 4 through 9, for the adjustment requirements.

NOTE: If additional refrigerant is needed, a crankcase heater will probably be required. (Refer to the appropriate refrigerant-tube sizing table.) When a crankcase heater is used, inform the homeowner that power must be turned on to the air conditioning unit at least 12 hours before the thermostat is turned to the COOLING position for spring startup.

A filter-drier is not normally required in the system when a complete system is used (condensing unit, refrigerant tubing, and evaporator coil). For exceptions to this rule, see Section II, "Installing Refrigerant Tubing," of the Standard Installation Practices booklet packaged with the unit.

To obtain optimum performance and efficiency with matching or mix-matched evaporator coils, it may be necessary to change the metering device. See Table 11 for necessary changes.

⚠ WARNING

Carefully relieve refrigerant pressure within this unit before final disposal.

GENERAL

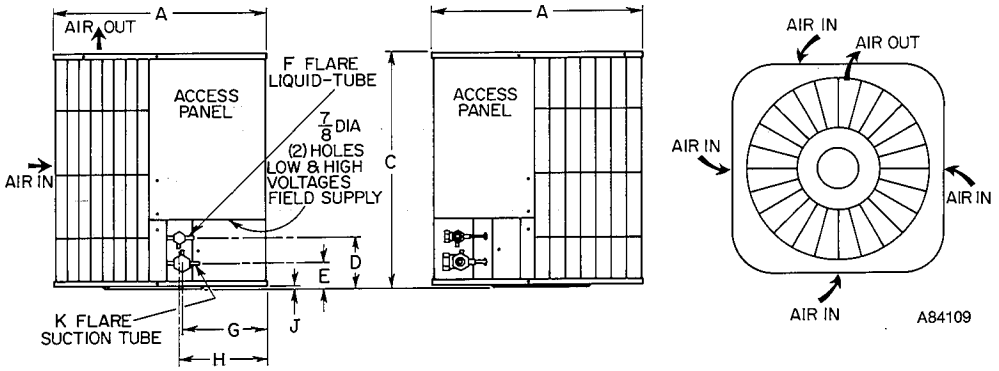
The condensing unit, as shipped from the factory, includes: a compressor, a condenser fan and motor, liquid and suction service valves, an air-cooled condenser coil, and all necessary electrical controls.

The condensing unit is designed for use with matching evaporator coils. An expansion valve is not required. However, the unit can be used with a suitable evaporator coil that uses an expansion valve with a pressure equalization feature during the off cycle. Expansion valves with this feature are available from your Distributor.

Installation comprises the following steps (sections):

I. Locating the Unit
II. Installing Refrigerant Tubing
III. Leak Testing
IV. Purging (if required)
V. Evacuation (if required)
VI. Electrical Connections
VII. Checking Charge
VIII. Adjusting Charge

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.



Clearance Requirements (In Inches)

Inlet air	12
Discharge air (top)	48
Service clearance (compressor end)	30

NOTE: The fan position on the motor shaft should be as close to the motor as possible without touching.

Fig. 2—Dimensional Drawing

Table 1—Dimensions (In Inches)

Size	A	C	D	E	F	G	H	J	K
014 & 018	21 1/8	26 9/16	6 5/16	1 13/16	3/8	5 3/4	5 7/8	1/4	5/8
024A	21 1/8	26 9/16	6 5/16	1 13/16	3/8	5 3/4	5 7/8	1/4	5/8
030B, 036A & 036D	21 1/8	26 9/16	6 5/16	1 13/16	3/8	5 3/4	5 7/8	1/4	3/4
042	27 3/8	26 9/16	6 3/8	1 7/8	3/8	11 9/16	11 3/4	11/32	3/4
048 & 060	27 3/8	30 9/16	6 3/8	1 7/8	3/8	11 9/16	11 3/4	11/32	3/4

Table 2—Specifications

Size		014	018	024A	030B	036A	036D	042	048	060
Refrigerant Type		R-22	R-22	R-22	R-22	R-22	R-22	R-22	R-22	R-22
Factory Refrigerant Charge	Lbs-oz	3-2	3-2	4-6	4-12	5-0	4-12	5-14	7-13	8-0
Refrigerant Tube* Connection Size (Flare)	Liquid	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
	Vapor	5/8	5/8	5/8	3/4	3/4	3/4	3/4	3/4	3/4
Approx Shipping Weight	Lbs	93	98	112	116	122	125	190	200	230

*Refer to appropriate refrigerant tube sizing table to determine correct liquid- and suction-tube diameters.

Table 3—Electric Connections

Size		014	018	024A	030B	036A	036D
Nameplate Volts—Phase (60-Hertz)		208-230—1	208-230—1	208-230—1	208-230—1	208-230—1	208-230—1
Operating Voltage Range		197-253	197-253	197-253	197-253	197-253	197-253
Unit Ampacity for Electrical Conductor Sizing		10.0	13.0	18.5	20.5	26.3	24.3
Total Unit Amps		8.0	10.4	15.0	16.6	21.2	19.6
Min Branch Circuit Wire Size	AWG No.	14	14	12	10	10	10
Copper Conductor*	Max Length In Ft†	100	75	80	131	90	90
Largest Wire Size Terminal Will Accommodate	Type Conn	Screw	Screw	Screw	Screw	Screw	Screw
	AWG No.	10	10	10	10	10	10
Max Branch Circuit Fuse Size‡	Amps	15	20	30	35	45	40

Size		042	048	060
Nameplate Volts—Phase (60-Hertz)		208-230—1	208-230—1	230—1
Operating Voltage Range		197-253	197-253	207-253
Unit Ampacity for Electrical Conductor Sizing		28.4	31.5	36.6
Total Unit Amps		23.0	25.5	29.6
Min Branch Circuit Wire Size	AWG No.	10	8	8
Copper Conductor*	Max Length In Ft†	90	125	110
Largest Wire Size Terminal Will Accommodate	Type Conn	Screw	Screw	Lug
	AWG No.	6	6	4
Max Branch Circuit Fuse Size‡	Amps	45	50	55

NOTE: Use copper wire only between disconnect switch and unit.

*If other than 75 C copper conductor is used, determine size from unit ampacity and the National Electric Code. Voltage drop of wire must be less than 2% of unit rated voltage.

†Length shown is as measured one way along the wire path between the unit and service panel for minimum 2% voltage drop.

‡Single-phase units may use fuses or HACR-type circuit breakers of same size as noted.

All of the above steps are covered in general by the like-numbered sections of the Standard Installation Practices in the back of this manual; therefore, this Installation Instruction will contain only supplementary information applicable to installing the condensing unit. It should be noted that evacuation and purging are not normally required when a complete matching system is installed. However, if any of the component parts are subject to contamination, or if tubing kits and matching coils are not used, the system must be purged or evacuated.

NOTE: Be sure to adjust system airflow per requirements of the fan-coil evaporator coil, and condensing unit combination.

In addition, the following sections should be reviewed by the equipment owner:

IX. Sequence of Operation

X. Care and Maintenance

I. LOCATING THE UNIT (Supplementary Instructions)

Select a location for the unit where water, ice, and snow will not fall from an overhang and damage the unit top or fan blade. Care must be exercised to maintain the clearance requirements listed on page 2 to assure proper access for servicing and to avoid recirculation of condenser air.

A. Determining Liquid-Tube Diameter

The correct liquid-tube diameter can be determined by using the appropriate table as described in steps 1 through 7 which follow. Be certain to use only the liquid-tube table that matches the size unit being installed. (See Tables 4 thru 9.)

1. Measure total one-way horizontal distance for intended tubing path.
2. Measure total one-way vertical distance for intended tubing path.
3. At left-hand end of table, select value that matches measured vertical length. Be sure to note that upper section of table is used if cooling coil is above unit, whereas lower section is used if cooling coil is below unit.
4. Move across this line towards right-hand side until correct vertical column is reached for measured horizontal length.
5. Correct diameter will be indicated at intersection of these lines.
6. If point of intersection falls within shaded area, crankcase heater must be added.
7. For applications where cooling coil is to be placed more than 50 feet below unit, see your Distributor for specific recommendations.

Here is an example: Unit is size 018. Cooling coil is located 43 feet above unit. Horizontal distance is 72 feet.

First, in the section marked "Coil Above Unit," find the line showing measurement of 41-50 feet. Follow this line towards the right until it intersects the vertical column marked 71-80 feet. The correct tube size is 3/8-inch OD, and the fact that the 3/8-inch size falls in the shaded area means that the unit will require a crankcase heater.

B. Instructions for Total System Charge

The total system refrigerant charge includes the condensing unit, the evaporator coil, and the interconnecting tubing. The factory charge is sufficient for a system using 25 feet of interconnecting tubing and a matching evaporator coil. For systems using tubing lengths other than 25 feet, adjust the charge in accordance with the notes under the proper table (4 thru 9).

If other than matching interconnecting tubing or evaporator coil is being used, use an accurate scale or volumetric charging cylinder (such as a Dial-A-Charge) and weigh in the refrigerant until the desired superheat temperature is obtained. See the superheat charging label attached to each condensing unit.

When system charging has been completed, stamp the total amount of refrigerant in the block provided on the condensing unit rating plate. The total system charge is the same as the field charge.

C. Determining Suction-Tube Diameter

The correct suction-tube diameter can be determined by using Table 10 as follows:

1. Measure total length (vertical and horizontal) of intended tubing path.
2. Find correct size at left of table.

   The tube lengths are shown in the center of the table with the appropriate diameters on the right.

IX. SEQUENCE OF OPERATION

When the thermostat "calls for cooling," the thermostat contacts close, energizing contactor holding coil 2A or 2D from a 24-volt external power source. The contactor closes, energizing compressor motor 3F or 3J and condenser fan motor 3C with supply voltage.

When the thermostat is satisfied, the contacts open, deenergizing contactor holding coil 2A or 2D and, in turn, breaking the supply voltage circuit. All motors should stop.

Table 4—Unit Size 014 & 018

	Vertical Distance (Ft)	Horizontal Distance—Feet 0 to 10	11 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	71 to 80	81 to 90	91 to 100
Coil Above Unit	41 to 50	5/16	5/16	5/16	5/16	5/16	5/16	5/16	3/8	3/8	3/8
	31 to 40	1/4	1/4	↓	↓	↓	↓	↓	5/16	5/16	5/16
	21 to 30	↓	↓	1/4	1/4	↓	↓	↓	↓	↓	↓
	11 to 20	↓	↓	↓	↓	1/4	1/4	1/4	↓	↓	↓
	0 to 10	↓	↓	↓	↓	↓	↓	↓	1/4	1/4	1/4
Coil Below Unit	0 to 10	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	11 to 20	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	21 to 30	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	31 to 40	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	41 to 50	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4

(1) Unit charge adequate for 1/4-in. OD tube lengths up to 25 ft. For lengths below or above 25 ft, adjust charge at rate of 0.2 oz/ft. This may be done by using superheat charging label.

(2) If 5/16-in. OD tube is selected, add 0.4 oz/ft for lengths greater than 15 ft.

(3) If 3/8-in. OD tube is selected, add 0.6 oz/ft for lengths greater than 9 ft.

(4) If tube size falls within shaded area, add crankcase heater.

Table 5—Unit Size 024

	Vertical Distance (Ft)	Horizontal Distance—Feet 0 to 10	11 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	71 to 80	81 to 90	91 to 100
Coil Above Unit	41 to 50	5/16	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
	31 to 40	↓	5/16	5/16	5/16	5/16	↓	↓	↓	↓	↓
	21 to 30	1/4	↓	↓	↓	↓	5/16	5/16	5/16	5/16	↓
	11 to 20	↓	1/4	1/4	↓	↓	↓	↓	↓	↓	5/16
	0 to 10	↓	↓	↓	1/4	1/4	↓	↓	↓	↓	↓
Coil Below Unit	0 to 10	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	11 to 20	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	21 to 30	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	31 to 40	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	41 to 50	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4

(1) Unit charge adequate for 1/4-in. OD tube lengths up to 25 ft. For lengths below or above 25 ft, adjust charge at rate of 0.2 oz/ft. This may be done by using superheat charging label.

(2) If 5/16-in. OD tube is selected, add 0.4 oz/ft for lengths greater than 15 ft.

(3) If 3/8-in. OD tube is selected, add 0.6 oz/ft for lengths greater than 9 ft.

(4) If tube size falls within shaded area, add crankcase heater.

Table 6—Unit Size 030B

	Vertical Distance (Ft)	Horizontal Distance—Feet 0 to 10	11 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	71 to 80	81 to 90	91 to 100
Coil Above Unit	41 to 50	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	3/8
	31 to 40	1/4									5/16
	21 to 30		1/4	1/4							
	11 to 20				1/4	1/4					
	0 to 10										
Coil Below Unit	0 to 10										
	11 to 20										
	21 to 30								1/4		
	31 to 40							1/4			
	41 to 50	1/4	1/4	1/4	1/4	1/4	1/4	5/16	5/16	5/16	5/16

Table 7—Unit Size 036A,D

	Vertical Distance (Ft)	Horizontal Distance—Feet 0 to 10	11 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	71 to 80	81 to 90	91 to 100
Coil Above Unit	41 to 50	1/4	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16
	31 to 40		1/4								
	21 to 30			1/4	1/4						
	11 to 20					1/4					
	0 to 10						1/4	1/4			
Coil Below Unit	0 to 10								1/4		
	11 to 20										
	21 to 30							1/4			
	31 to 40										
	41 to 50	1/4	1/4	1/4	1/4	1/4	1/4	5/16	5/16	5/16	5/16

Table 8—Unit Size 042

	Vertical Distance (Ft)	Horizontal Distance—Feet 0 to 10	11 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	71 to 80	81 to 90	91 to 100
Coil Above Unit	41 to 50	5/16	5/16	5/16	5/16	5/16	3/8	3/8	3/8	3/8	3/8
	31 to 40						5/16	5/16			
	21 to 30								5/16	5/16	5/16
	11 to 20										
	0 to 10										
Coil Below Unit	0 to 10										
	11 to 20										
	21 to 30										
	31 to 40										
	41 to 50	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16

Table 9—Unit Size 048

	Vertical Distance (Ft)	Horizontal Distance—Feet 0 to 10	11 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	71 to 80	81 to 90	91 to 100
Coil Above Unit	41 to 50	5/16	5/16	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
	31 to 40			5/16	5/16						
	21 to 30					5/16	5/16				
	11 to 20							5/16	5/16		
	0 to 10									5/16	5/16
Coil Below Unit	0 to 10										
	11 to 20										
	21 to 30										
	31 to 40										
	41 to 50	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16

(1) Unit charge adequate for 3/8-in. OD tube lengths up to 25 ft. For lengths below or above 25 ft, adjust charge at rate of 0.6 oz/ft. This may be done by using superheat charging label.

(2) Unit charge adequate for 1/4-in. OD tube lengths up to 75 ft. For lengths above 75 ft, adjust charge at rate of 0.2 oz/ft.

(3) Unit charge adequate for 5/16-in. OD tube lengths up to 40 ft. For lengths above 40 ft, adjust charge at rate of 0.4 oz/ft.

(4) If tube size falls within shaded area, add crankcase heater.

Table 10—Unit Size 060

	Vertical Distance (Ft)	Horizontal Distance—Feet 0 to 10	11 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	71 to 80	81 to 90	91 to 100
Coil Above Unit	41 to 50	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
	31 to 40	5/16									
	21 to 30		5/16	5/16							
	11 to 20				5/16	5/16					
	0 to 10						5/16				
Coil Below Unit	0 to 10								5/16		
	11 to 20										
	21 to 30							5/16			
	31 to 40										
	41 to 50	5/16	5/16	5/16	5/16	5/16	5/16	3/8	3/8	3/8	3/8

Table 11—Recommended Suction-Tube Diameters

Size	Suction-Tube Length (Feet)	Recommended Diameter (Inches)
014 & 018	0 to 150	5/8
024	0 to 120	5/8
	120 to 150	7/8
030	0 to 85	3/4
	85 to 150	7/8
036	0 to 60	3/4
	60 to 135	7/8
042	0 to 85	7/8
048	0 to 85	7/8
	85 to 150	1 1/8
060	0 to 65	1 1/8
	65 to 150	1 3/8

NOTE: The above table is based on a tube loss of 2 F. Longer lengths can be used in each diameter listed, or smaller diameters may be used, but the result will be larger tube losses with a lower unit capacity and efficiency rating. Refer to your Distributor or Branch for specific details.

Table 12—Required Piston Size For Indoor Coil

Condensing Unit Size	Piston Identification No.
018	52
024	59
030	65
036 10	76
036 30	70
042 and 048	82
060	93

NOTE: The piston sizes listed in this table are for systems where the vertical separations between indoor and outdoor units do not exceed 10 feet. For vertical separations exceeding 10 feet, consult the factory for the proper piston sizes.

Optional Start Assist (When Used)

⚠ CAUTION

Do not use both the start thermistor (PTC) 4K and start kit 2K and 4D on the same unit at one time.

Start thermistor 4K is wired in parallel to run capacitor 4G on single-phase units. Its purpose is to provide additional start assist. When compressor 3J starts, start thermistor 4K builds its internal resistance to a level where it effectively removes itself electrically from circuit. When contactor 2A or 2D is deenergized, start thermistor 4K will automatically reset itself in approximately 3 to 5 minutes.

Start Kit 2K and 4D

The start kit consists of start relay 2K and start capacitor 4D. Start capacitor 4D helps compressor 3J start. When the compressor starts, start relay 2K disconnects start capacitor 4D from the circuit, allowing compressor 3J to run on run capacitor 4A or 4G. When contactor 2A or 2D de-energizes, start relay 2K reconnects the start capacitor in the circuit, making it ready for the next compressor start.

X. CARE AND MAINTENANCE

For continuing high performance, and to minimize possible equipment failure, it is essential that periodic maintenance be performed on this equipment. Consult your local Dealer for the proper frequency or maintenance and the availability of a maintenance contract.

The air for the condenser coil is drawn into the unit on four sides and discharged out the top. Keep the air inlet and outlet grilles unplugged and clear of any obstructions at all times. Never cover the unit or lean anything against it which might restrict airflow or cause hot air from the top grille to recirculate into the sides. Keep trash and debris away from the unit at all times. Never stand on the unit or use it as a support for ladders, etc.

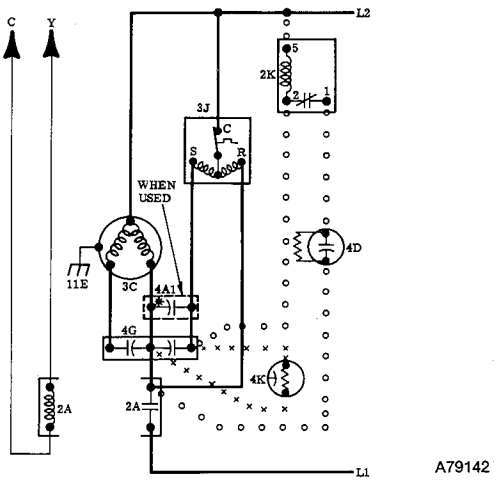


Fig. 3—Typical Single-Phase Wiring

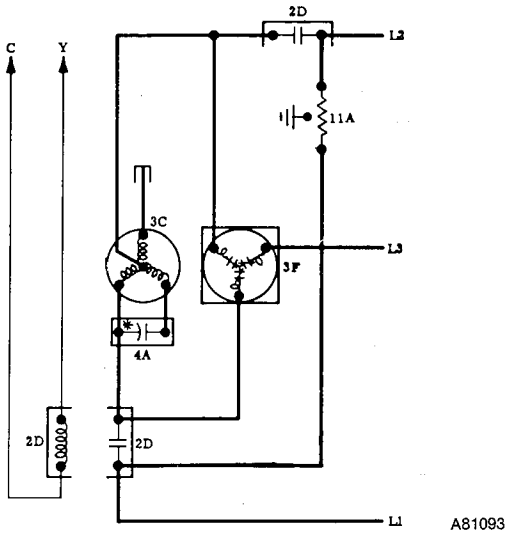


Fig. 4—Typical Three-Phase Wiring

— — — FIELD LOW VOLTAGE
— — — FIELD HIGH VOLTAGE
_____ FACTORY LINE VOLTAGE
_____ FACTORY LOW VOLTAGE

○○○ STARTING CIRCUIT
LINE VOLTAGE (WHEN USED)
XXX ALTERNATE STARTING CIRCUIT
LINE VOLTAGE (WHEN USED)

LEGEND

2A-Contactor SPST
2D-Contactor DPST
2K-Start Relay (When Used)
3C-Condenser Fan Motor
3J-Compressor (Single-Phase)
4A1-Run Capacitors
4D-Start Capacitor (When Used)
4G-Run Capacitor (Dual)
4K-Start Thermistor (When Used)
11A-Crankcase Heater (When Used)
11E-Ground

FIELD WIRING DIAGRAMS

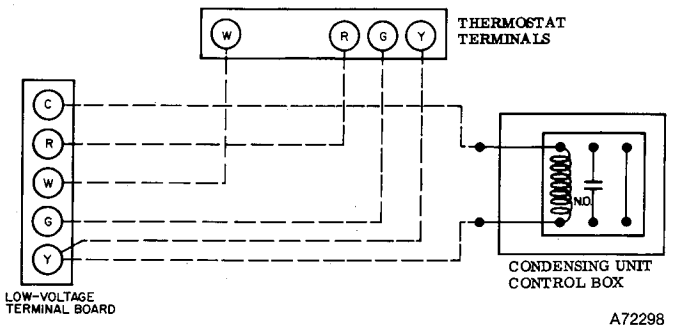


Fig. 5—Typical Field Low-Voltage Wiring

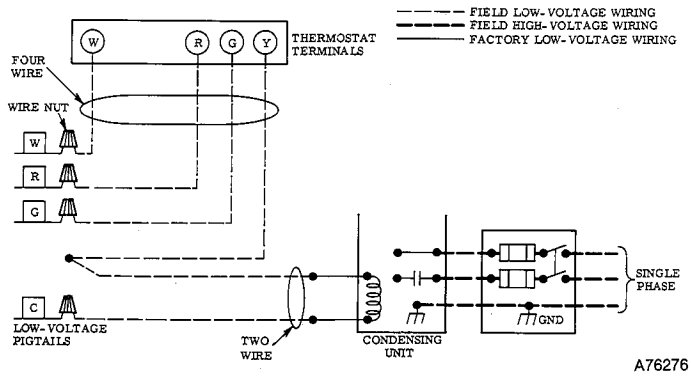


Fig. 6—With Fan-Coil Unit (For cooling-only, delete W.)

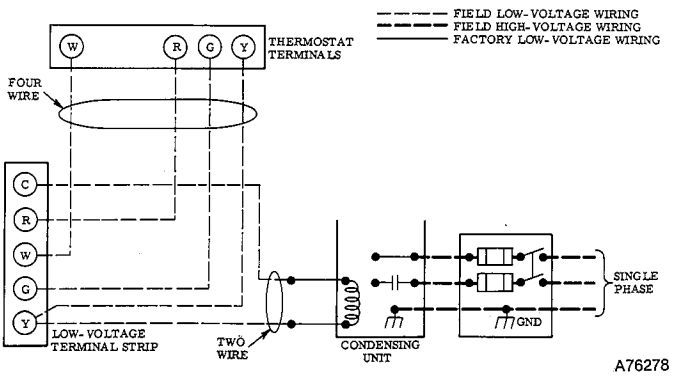


Fig. 7—With Blower Package (For cooling-only, delete W.)

The refrigerant tubing connecting this unit with the cooling coil is easily crushed or crimped. Therefore, do not hang or stand anything on it. Do not move the unit after it has been installed, as this may crimp the tubing and cause the unit to malfunction.

The ability to properly perform maintenance on this equipment requires certain mechanical skills and tools. If you do not possess these, contact your Distributor for maintenance.

⚠ WARNING

This system contains oil and refrigerant under pressure. *Do not* use a torch when disconnecting refrigerant components. Wear safety goggles and adhere to the following:

1. Turn off electrical power to unit.
2. Relieve all pressure from system.
3. Cut component connecting tubing with tubing cutter and remove component from unit.
4. Carefully unsweat tubing stubs from component. Oil may ignite when exposed to torch flame.

⚠ WARNING

Do not energize or operate compressor with the terminal box cover removed. Turn off the main disconnect before removing the terminal box cover. Electrical shock can cause personal injury or death.

⚠ WARNING

Disconnect all electrical power to the unit before performing any maintenance or service on the condensing unit. Remember also to disconnect the power supply to the furnace or air handler as this unit supplies low-voltage power to the condensing unit. Electrical shock can cause personal injury or death.

The minimum maintenance that should be performed on this equipment is as follows:

1. Check condenser coil for cleanliness each month during cooling season. Clean as necessary, but at least once at the beginning of each cooling season. To insure reliable performance in sea coast or contaminated atmosphere installations, the unit must be kept free of debris and the condenser coil flushed with fresh water at least once a month. See Section X, item A, for proper procedures.
2. Check fan motor and blade for cleanliness and lubrication each cooling season. Clean and lubricate as necessary.
3. Check electrical connections for tightness and controls for proper operation each cooling season. Service as necessary.

⚠ CAUTION

Because of possible damage to the equipment or personal injury, maintenance should be performed by qualified persons only.

Table 13—Trouble Analysis Chart

SYMPTOM	CAUSE	REMEDY
Compressor and condenser fan will not start	Power failure	Call power company.
	Fuse blown or circuit breaker tripped	Replace fuse or reset circuit breaker.
	Defective thermostat, contactor, or control relay	Replace component.
	Low line voltage	Determine cause and correct.
	Incorrect or faulty wiring	Check wiring diagram and rewire correctly.
	Thermostat setting too high	*Lower thermostat setting below room temperature.
Compressor will not start, but condenser fan run	Faulty wiring or loose connections in compressor circuit	Check wiring and repair or replace.
	Compressor motor burned out, seized, or internal overload open	Replace compressor and determine cause.
	Defective run capacitor	Determine cause and replace.
	Refrigerant over or under charged	Blow refrigerant, evacuate system, and recharge.
Compressor cycle (other than normally satisfying thermostat)	Defective compressor	Replace and determine cause.
	Low line voltage	Determine cause and correct.
	Blocked condenser	Determine cause and correct.
	Defective run capacitor	Determine cause and replace.
	Defective thermostat	Replace thermostat.
	Faulty condenser fan motor or capacitor	Replace.
	Restriction in refrigerant system	Locate restriction and remove.
Compressor operates continuously	Unit undersized for load	Decrease load or increase unit size.
	Thermostat set too low	*Reset thermostat.
	Low refrigerant change	Locate leak; repair and recharge.
	Leaking valves in compressor	Replace compressor.
	Air in system	Blow refrigerant, evacuate system, and recharge.
	Condenser coil dirty or restricted	Clean coil or remove restriction.
Excessive head pressure	Dirty condenser coil	Clean coil.
	Refrigerant overcharged	Purge excess refrigerant.
	Air in system	Blow refrigerant, evacuate system, and recharge.
	Condenser air restricted or air short-cycling	Eliminate cause.
Head pressure too low	Low refrigerant charge	Check for leaks, repair and recharge.
	Compressor valves leaking	Replace compressor.
	Restriction in liquid tube	Remove restriction.
Excessive suction pressure	High heat load	Check for source and eliminate.
	Compressor valves leaking	Replace compressor.
	Refrigerant overcharged	Purge excess refrigerant.
Suction pressure too low	Low refrigerant charge	Check for leaks; repair and recharge.
	Metering device or low side restricted	Remove source of restriction.
	Low evaporator air	Increase air.
	Temperature too low in conditioned area	*Reset thermostat.

*Thermostat should be set between 72 and 78 F.

⚠ WARNING

As with any mechanical equipment, personal injury can result from sharp metal edges, etc.; therefore, be careful when removing parts.

A. Condenser Coil.

Remember to disconnect electrical power before removing any panels.

Since the air is drawn into the sides of the unit and discharged out the top, most of the dirt will collect on the outside surface of the coil. However, some dirt will penetrate the coil. This condition is very difficult to see without removing the top cover.

To properly check the condenser coil for cleanliness, or to clean the coil; proceed as follows:

1. Remove top cover. Enough motor wire is provided so that the top cover can be laid on edge without disconnecting the motor leads. (Clip wire tie to release wire.)
2. Clean coil by spraying from inside outward with high-velocity stream of water. (Garden hose is sufficient.)

Be careful not to damage the coil fins. Be sure to wash the dirt from the coil. Space has been provided under the coil to flush away the dirt. Drain holes are also provided in the base pan. Be sure they are open. If the coil is coated with oil or grease, it can be cleaned with a mild detergent or an approved coil cleaning agent, then rinsed with clear water. Be careful not to get water in the compressor and unit control boxes.

B. Condenser Fan Motor and Blade

Remember to disconnect electrical power before removing any panels.

1. Remove screws holding top cover.
2. Lift top with motor and fan blade out of hole. Do not cut or stretch motor electrical leads. Be careful not to bend fan blade.
3. Clean motor and blade with soft brush or rag. Be careful not to disturb balance weights on fan blade.
4. Check fan blade setscrew for tightness.
5. Lubricate fan motor.
   a. Remove dust caps or plugs from oil holes located at each end of motor.
   b. Use teaspoon, 5cc, $^{3}/_{16}$ oz. or 16 or 25 drops of good grade SAE 20 nondetergent motor oil in each hole. Allow time for total quantity to be absorbed by each bearing.
   c. Wipe excess oil from motor housing.
   d. Replace dust caps or plugs in oil holes.
6. To reassemble unit:
   a. Reinstall top cover with fan motor and blade.
   b. Push excess motor leads back into wire retainer and replace all screws.
   c. Reconnect electrical power and check fan for proper operation.

C. Electrical Controls and Wiring

With power disconnect to unit, check all electrical connections for tightness. Tighten all screws on electrical connections. If any smoky or burned connections are noticed, disassemble the connection, clean all parts and stripped wire, reassemble properly, (Use new connector if old one is burned or corroded.) and secure tightly. Electrical controls are difficult to check without proper instrumentation; therefore, reconnect the electrical power to the unit and observe the unit through one complete operating cycle.

If there are any discrepancies in the operating cycle, contact your Distributor and request service.

D. Refrigerant Circuit

The refrigerant circuit is difficult to check for leaks without proper equipment. Therefore, if low cooling performance is suspected, contact your local Distributor for service.

Standard Installation Practices

This Standard Installation Practices publication is intended for use with all electric air conditioning units ranging from 14,000 thru 60,000 Btuh.

Modern air conditioning systems consist of a remotely located condensing unit, an evaporator coil, and interconnecting refrigerant tubes. The proper installation of each of these components will insure that the system will provide the comfort for which it is designed. The following pages list the minimum steps to be taken during the installation of an air conditioning unit.

⚠ WARNING

This equipment contains moving parts, high voltage, and refrigerant under pressure. As a result, anyone working on this equipment must observe all accepted safety rules and procedures to avoid personal injury. This includes wearing of protective apparel, safety glasses, and disconnecting the electrical power before removing equipment panels.

In general, the condensing unit should be located remotely from the evaporator coil and have adequate clearances for airflow and service. The evaporator coil should be located in an air handler that has enough capacity to load the coil and, the refrigerant tubes should be as short as practical. Extreme care should be taken when installing the system to avoid contaminating it with air and moisture: Either contaminant will cause a system failure.

When the system is placed in operation, it is important that the homeowner be informed of the maintenance steps required to keep the system in proper operation. Among these are the following:

⚠ WARNING

Before attempting to perform any service on or to remove any panel from the condensing unit or air handler, be sure that electrical power is disconnected and the switch locked to avoid personal injury or death. (A unit may have more than one disconnect switch.)

1. Keep air filter in place when system is in operation; replace or clean it regularly.
2. Keep condenser coil clean, and do not obstruct airflow.
3. If system has crankcase heater, turn on power to unit at least 12 hours before thermostat is turned to cooling for spring startup.

4. It is not recommended that condensing unit be operated below 55 F outdoor temperature. If operation below this temperature is desired, the optional low-ambient kit, available from your Distributor, is required.

The following sections, when used in conjunction with the detailed unit instructions, are the steps needed to complete the installation of an air conditioning system. If more detailed instructions are required, see your Distributor.

I. LOCATING THE UNIT

This condensing unit is approved for outdoor installations.

1. Consult local codes or ordinances for restrictions regarding location of unit.
2. Consult dimensional drawing for following:
   a. Location of refrigerant connections and electrical connections.
   b. Recommended clearances.
   c. Direction of condenser airflow.
   d. Mounting base dimensions.
3. Place unit on level base strong enough to support weight of unit and to resist effects of frost heaving, etc. Concrete lintels can be used if spaced to adequately support unit.
4. Allow air to circulate under unit. Legs or bases are provided on most units for this purpose. If legs or bases are not provided, spacers can be obtained from your Distributor—or unit may be set on a bituminous mixture, such as roofing tar, to prevent base pan from rusting. Do not plug drain holes.
5. On rooftop applications, locate unit at least 6 inches above roof surface. Where possible, place unit above a load-bearing wall. Arrange supporting members to adequately support unit and minimize transmission of vibration to building. Either precast concrete lintels, concrete blocks, treated timbers, or steel beams can be used. Consult local codes governing rooftop applications.
6. Avoid locations where flowers, shrubs, etc. are in pathway of condenser discharge air, or where condenser fan will discharge against prevailing wind or building. Select a location for the unit where ice and snow will not fall from an overhang and damage the unit top or fan blade.
7. Avoid locations where normal operating sounds may be objectionable, such as beneath windows, between structures, or near patios. Should operating sounds be objectionable, consideration should be given to a shielding barrier. Consult your Distributor or the current publication of ARI Standard 270 for assistance in determining a suitable location with minimum of operating sounds.
8. Keep distance between evaporator coil and condensing unit as short as possible.
9. Consult your Distributor regarding roof-mounted condensing units on multilevel buildings.

OPENING AND CLOSING OF VALVES

1. Use correct tool.
2. Remove valve stem cap.
3. Front-seat—turn clockwise until valve stem bottoms. Do not overtighten.
4. Open—turn counterclockwise until stem just contacts snapring in valve body. Do not overtighten.
5. Replace valve stem cap and be sure that it is tight.

II. INSTALLING REFRIGERANT TUBES

IMPORTANT: The condensing unit is charged at the factory. Be sure both service valves are front seated (turned clockwise) to avoid loss of the charge. DO NOT REMOVE REFRIGERANT TUBE CONNECTION SEALS FROM THE CONDENSING UNIT, THE MATCHING EVAPORATOR COIL, OR THE REFRIGERANT TUBING, UNTIL READY TO MAKE THE ACTUAL CONNECTION AT THE POINT OF SEAL.

If either refrigerant tubing or evaporator coil is exposed to atmospheric conditions for longer than 5 minutes, they must be purged. See Section IV, "Purging," for the proper method.

If other than matched refrigerant tubing is used, select an approved (type-L) refrigerant tubing of the correct size. **(DO NOT USE WATER TUBING.)** Flare this tubing, using a standard 45-degree SAE flaring tool. Insulate the suction tube with an insulation having an adequate vapor barrier (e.g. Armaflex or Ensolex). It will be necessary to evacuate this tubing and evaporator coil. See Section V, "Evacuation," for proper method.

NOTE: All refrigerant tube joints erected on the premises should be exposed to view for visual inspection and leak testing before being covered or enclosed.

When a complete system (condensing unit, refrigerant tubing, and evaporator coil) is used, a filter-drier is not required in the system. However, if other than matched refrigerant tubing or coils are used, or if the refrigerant tubing or coil is exposed to atmospheric conditions for longer than 10 minutes; a filter-drier must be installed in the system at the coil. (An appropriate size of filter-drier is available from your Distributor.)

NOTE: Additional refrigerant must be added to the system and compensate for the additional volume of the filter-drier, and different tubing lengths.

Install refrigerant tubes as follows:

1. Consult local codes or ordinances before running refrigerant tubes.
2. Install evaporator coil in accordance with instructions packaged with coil.
3. If evaporator coil requires thermal expansion valve, obtain proper valve from your Distributor and install in accordance with instructions packaged with evaporator coil.
4. Run refrigerant tubes as directly as possible, avoiding unnecessary turns and bends.
5. Tape liquid tube to top of insulated suction tube for support. See Fig. 3.
6. Suspend refrigerant tubes so they do not damage insulation on suction tube and do not transmit vibration to structure. See Fig. 3. Also, when passing refrigerant tubes through wall, seal opening so vibration is not transmitted to structure. Leave some slack in refrigerant tubes between structure and unit to absorb vibration.
7. If refrigerant tubes are too long, they should be rolled into loop and placed in horizontal plane with end leaving loop going to compressor, coming out of bottom. If desired, excess may be cut off and tubing braised.
8. Be sure both service valves are front seated (turned clockwise). It is necessary to remove valve stem caps to check.
9. When required, connect filter-drier (available from your Distributor) in liquid tube at evaporator coil.

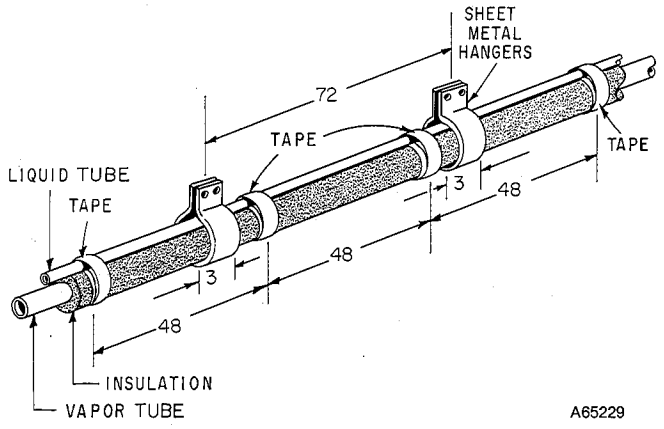


Fig. 8—Recommended Method to Support Refrigerant Tubing

NOTE: The flow directional arrow, located on the label of the filter-drier, must point toward the evaporator coil.

10. Connect tubing to condensing unit and evaporator coil, as shown in Fig. 2. DO NOT REMOVE SEALS UNTIL READY TO MAKE THE ACTUAL CONNECTIONS AT POINT WHERE SEAL IS REMOVED.
11. Refrigerant tubing and evaporator coil is now ready for leak testing.

III. LEAK TESTING

No installation is complete until the entire system has been checked for leaks. This check should include all field and factory joints. To check a system for leaks, proceed as follows:

1. Remove valve stem caps from both service valves and check to be sure valves are front seated (turned clockwise). Remove gauge port caps.
2. Attach gauge manifold to ports on service valves. Hoses of gauge manifold must have valve core depressors.

NOTE: NEVER USE A UNIT CHARGE FOR LEAK TESTING.

4. Leak-test with electronic detector, halide torch, or liquid-soap solution.
5. Release pressure and repair any leaks found. Repeat leak test as necessary.

⚠ WARNING

NEVER ATTEMPT TO REPAIR ANY SOLDER CONNECTIONS WHILE SYSTEM IS UNDER PRESSURE. PERSONAL INJURY COULD RESULT.

6. When system is free of leaks, proceed as follows:
   a. If system is to be purged, leave service valves in front-seat position. Leave gauge manifold attached to system and proceed to Section IV.
   b. If system is to be evacuated, leave service valves in front-seat position. Remove refrigerant cylinder from gauge manifold and proceed to Section V.
   c. If system is to be started and the checking charge procedure is to follow, open (counterclockwise) both service valves. Then proceed to step 3, Section VII.
   d. If system is to be left in the leak-tested condition, open (Turn counterclockwise.) both service valves and remove gauge manifold. Replace caps on gauge ports and valve stems. Be sure they are tight!

IV. PURGING

If either the refrigerant tubing kit or the evaporator coil is exposed to atmospheric conditions during installation for longer than 5 minutes, the refrigerant tubing and the evaporator coil must be purged.

NOTE: DO NOT USE THE UNIT CHARGE TO PURGE THE REFRIGERANT TUBING. To purge the refrigerant tubing and the evaporator coil, proceed as follows:

1. Disconnect hose from low side of gauge manifold.
2. Open valves on R-22 refrigerant cylinder and high side of gauge manifold. Allow approximately ½ to 1 pound of refrigerant vapor to flow through system and out hose attached to gauge port on suction service valve.

⚠ CAUTION

Be careful when venting refrigerant while purging or connecting and disconnecting gauge manifold hoses. Refrigerant is at a very low temperature and frostbite can occur.

3. Pressurize system with refrigerant to 10 psig and close valves on refrigerant cylinder and gauge manifold. Reattach hose to low side of gauge manifold.
4. Open (Turn counterclockwise.) both service valves. Remove gauge manifold from gauge ports of service valves and replace valve stem and gauge port caps (Be sure they are tight.) if system is to be left in the purged condition, it will not be necessary to remove gauge manifold if checking charge procedure is to follow.

V. EVACUATION

It is extremely important to have an installation in which all refrigerant tubes and system components are completely free of air and moisture. If, during the installation, the refrigerant tubing kit or the evaporator coil becomes contaminated with moisture or liquid water, or other than matching components are used; the refrigerant tubes and evaporator coil must be evacuated.

If the installer can pull the system down to a reading of 1000 microns or less with his deep vacuum equipment, he can consider the system free of air and moisture when this level is reached.

If, however, the installer has an evacuation pump (one which will only pull a vacuum of approximately 28 inches) rather than a deep vacuum pump, he must triple-evacuate the system with the required number of purges and holding periods. The initial preparation for evacuation of the refrigerant tubing and evaporator coil is as follows:

1. Connect evacuation equipment to system through gauge manifold.
2. Evacuate system, following appropriate steps for type of evacuation equipment used.
3. Pressurize system with refrigerant to 10 psig and open (Turn counterclockwise) both service valves.
4. Remove gauge manifold. Replace valve stem and gauge port caps on both service valves (Be sure they are tight) if system is to be left in evacuated condition. It will not be necessary to remove gauge manifold if checking-charge procedure is to follow.

VI. ELECTRICAL CONNECTIONS

IMPORTANT: Before proceeding with the electrical connections, make certain that the volts, hertz, and phase corre-

spond to that specified on the unit rating plate. Also, check to be sure that the service provided by the utility is sufficient to handle the additional load imposed by this equipment. Refer to the Ratings and Performance table in the detailed unit instruction and unit rating plate for equipment electrical requirements.

The attached wiring diagrams show the proper field high- and low-voltage wiring. Make all electrical connections in accordance with the National Electrical Code and any local codes or ordinances that might apply.

Use a separate branch electrical circuit for this unit. A disconnecting means must be located within sight of, and readily accessible to, the unit.

⚠ CAUTION

If the disconnect switch is to be mounted on the condensing unit, select a location where the drill or fastener will not contact electrical or refrigerant components.

⚠ WARNING

The unit cabinet must have an uninterrupted or unbroken electrical ground to minimize personal injury if an electrical fault should occur. This may consist of an electrical wire or approved conduit when installed in accordance with existing electrical codes.

NOTE: We require the use of copper wire between the disconnect switch and the unit. Whenever aluminum wire is used in the branch circuit wiring with this unit, adhere to the following recommendations: Connections must be made in accordance with the National Electrical Code, using connectors approved for aluminum wire. The connectors must be UL approved (marked AL/Cu with the UL symbol) for the application and wire size. In preparing the wire, just before installing the connector, all aluminum wire must be "brush-scratched" and coated with a corrosion inhibiter such as Pentrox A. When it is suspected that the connection will be exposed to moisture, it is very important to cover the entire connection completely to prevent an electrochemical action that will cause the connection to fail very quickly. Do not reduce the effective size of wire, such as cutting off strands so that the wire will fit a connector. Proper size connectors should be used.

If aluminum conductors are to be used, the wire size selected must have a current capacity not less than that of the copper wire specified, and must not create a voltage drop between the service panel and the unit in excess of 2% of the unit rated voltage.

Check all electrical connections (both factory and field) for tightness. This should also be done after the unit has reached operating temperatures, especially if aluminum conductors are used.

MR. ELECTRICIAN, PLEASE NOTE: DO NOT ATTEMPT TO OPERATE THIS CONDENSING UNIT UNTIL ALL REFRIGERANT CONNECTIONS HAVE BEEN MADE AND BOTH SERVICE VALVES HAVE BEEN CHECKED FOR THE OPEN POSITION. (TURNED COUNTERCLOCKWISE.) IT IS NECESSARY TO REMOVE THE VALVE STEM CAPS TO CHECK.

The single-phase compressor motor used in this condensing unit may be a permanent-split-capacitor-type (PSC) motor, designed to start under low-load conditions only; therefore, make sure that the system pressures have equalized before attempting to start the unit: this takes approximately 3 minutes. Do not short-cycle the unit with the thermostat or disconnect, as this will cause the compressor to tripout on overload. For starting under most load conditions, an optional starting kit is available from your Distributor.

VII. CHECKING CHARGE

No installation is complete until the operating charge level of the unit is checked. The level of refrigerant operating charge will determine how efficiently and economically the unit will operate. An overcharged or undercharged unit will lead to insufficient cooling, high operating costs, and the possibility of a compressor failure. To check the refrigerant charge level, proceed as follows:

1. Remove valve stem caps from both service valves and check valve stems for open position (counterclockwise).
2. Remove gauge port cap from both service valves and attach gauge manifold. Purge gauge manifold and hoses.
3. Start unit and allow it to run until operating conditions stabilize and pressures level out.
4. Evaluate system performance and refrigerant charge level by determining following information:
   a. Low-side pressure gauge reading.
   b. Dry-bulb temperature of inlet air at condenser coil.
   c. Wet-bulb temperature of inlet air at evaporator coil. This may be read at central return-air grille.
   d. Liquid- or suction-tube temperature at respective service valve.

NOTE: Use an accurate superheat, thermocouple, or thermistor-type thermometer.

   e. Compare these readings to those listed on Unit Charging Label located on unit. Add or remove refrigerant as required.

NOTE: The suction-tube connection of the compressor must be as cool as the suction tube, and the compressor base should be warm.

5. When correct refrigerant charge level is obtained, remove gauge manifold.
6. Replace valve stem and gauge port caps. (Be sure they are tight.)

NOTE: Where applicable, stamp the total number pounds of refrigerant charge onto the rating plate in the space provided.

VIII. ADJUSTING CHARGE

If, after checking the operating charge level, the unit is found to be undercharged or overcharged, refrigerant may be added or removed through the gauge manifold and the suction service valve.

To add refrigerant to a unit, proceed as follows:

1. Connect clean, dry cylinder of R-22 to center port connection of gauge manifold. Purge hose and connect gauge manifold to service valves.
2. With refrigerant cylinder in upright position, open valve on cylinder and slowly open valve on low-pressure gauge of manifold. Add refrigerant in vapor form until proper amount has been added.
3. When correct refrigerant charge level is obtained, close valves on refrigerant cylinder and gauge manifold.
4. Remove gauge manifold from service valves. Replace valve stem and gauge port caps. (Be sure they are tight.)

To remove refrigerant from a unit, proceed as follows:

1. Slowly open valve on low-pressure gauge side of manifold and vent refrigerant (slowly) through center port connection of gauge manifold.

⚠ CAUTION

Be careful of frostbitten fingers when venting and connecting or disconnecting gauge manifold hoses.

2. When desired amount of refrigerant has been removed to obtain correct refrigerant charge level, close valve on low-pressure gauge side of manifold.
3. Remove gauge manifold from both service valves. Replace both valve stem and gauge port caps. (Be sure they are tight.)

CHECKOUT LIST

⚠ WARNING

Turn off electrical power. Electrical shock can cause personal injury or death.

WITH ELECTRIC POWER OFF:

1. Check all electrical wiring (both factory and field) for completeness and tighten all electrical connections (contactor, capacitors, relays, etc.).
2. Check condenser fan blade for proper insertion depth in orifice plate.
3. Check evaporator blower pulley and motor pulley (belt-drive units only) for proper belt alignment and tightness. (Should have 1-in. of sag with normal finger pressure.)
4. Tighten all setscrews (evaporator blower, blower pulley, motor sheave, and condenser fan blade).
5. Check condenser airflow for obstructions.
6. Clean or replace air filters. Do not operate system without air filters in place.
7. Leak-test all refrigerant connections (fittings, joints, gaskets, flanges, etc.)—both factory and field—with a halide torch or electronic leak detector.
8. Replace all caps on service valves. Be sure they are tight.
9. Check to be sure all tools and loose parts have been removed from unit.
10. Check to be sure panels, covers, and screws are in place.
11. Following initial inspection, start unit and:
    a. Check condenser fan and evaporator blower for proper rotation.
    b. Adjust furnace or evaporator blower for proper airflow (approximately 400 cfm/ton).
    c. Check line and low voltage. (Should be within operating voltage range stamped on unit rating plate.)
    d. Check unit for proper operating refrigerant charge. (See unit head pressure charging chart.)
    e. Check compressor current draw in amps.
    f. Check unit for excessive noise, refrigerant tubing for excessive vibration and for contact with other parts. Correct as necessary.
    g. Do not leave installation until unit has been observed through one or two complete cycles. Make certain at this time all components are operating in correct sequence.
12. Thoroughly explain to owner(s):
    a. Operation of air conditioning system (thermostat, reset controls, etc.).
    b. Care and maintenance instructions (cleaning air filters, condenser and evaporator coils, blower wheel, and lubrication of all motors and blower bearings).
    c. Factory and dealer warranties and how to obtain service, if necessary.
    d. Leave copy of Owner's Manual with customer after you have completed necessary information in Owner's Manual.